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⑩ **CANADIAN PATENT**

④4 **SYNTHETIC TURF SURFACE AND METHOD OF MAKING THE SAME**

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No. OF CLAIMS 13

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This invention relates to synthetic turf surfaces and more particularly to simulated grass carpeting suitable for outdoor recreational purposes.

It is known to make simulated-grass carpeting or synthetic turf for recreational uses such as golf greens, etc. Conventionally, these simulated turf surfaces include a backing from which extends a plurality of filaments simulating grass. One of the biggest objections to known materials of this type is that ball roll on such a surface is not always true. For example, a golf ball stroked on such a surface will deviate or drift from a straight line path as it slows to a stop unless it is stroked along a line parallel to the warp direction. This is, of course, undesirable since the golfer cannot depend upon the ball to travel along a straight line.

In addition, existing simulated turf surfaces do not decelerate golf balls at the same rate as natural turf. Generally, conventional synthetic turf is only $1/2$ to $1/3$ as effective as natural turf in decelerating a golf ball. In other words a golf ball stroked with a given force, will travel 2 to 3 times as far on conventional simulated turf surfaces as it will on natural turf. This is another disadvantage of conventional

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synthetic turf. With these problems in mind, one of the objects of this invention is to provide a novel and improved synthetic turf and a method of making the same.

Another object of this invention is to provide a simulated turf or grass recreational surface which does not have a tendency to deflect a rolling ball from a straight line path and a method of making the same.

A further object of this invention is to provide a simulated-grass recreational surface having the appearance of natural grass and a method for making the same.

Still another object of this invention is to provide a synthetic turf having ball deceleration characteristics similar to natural turf and a method for making the same.

A further object of this invention is to provide a simulated-grass recreational surface which has a backing from which extends a plurality of synthetic filaments in ribbon form, portions of the synthetic filaments having a molecular orientation which varies from one side of the filament to the other.

Other objects and advantages of the invention will become apparent when the following detailed description is read in conjunction with the appended drawing, in which

Figure 1 is a perspective view of a swatch of the synthetic turf or recreational surface of the present invention,

Figure 2 is an enlarged cross-sectional view showing the manner in which the looped pile is cut and pulled out of the backing layer to provide a cut pile carpet,

Figure 3 is an enlarged view of a conventional wire used in a carpet loom showing the knife utilized to cut the looped pile,

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Figure 4 is a perspective view of a carpet loom wire with the cutting blade removed, and

Figure 5 is an enlarged cross-sectional view showing the manner in which the pile filaments are pulled across the sharp corners of the wire as the wire is withdrawn from the row of loops.

In accordance with the present invention there is provided a synthetic turf having a backing and a plurality of synthetic thermoplastic monofilaments extending therefrom. The
10 filaments extend from the backing in at least two lengths. One of said lengths extends from the backing a distance which is at least twice the distance of the other length. This longer length has a curved portion. For convenience, the short length will be referred to as a first length and the long length will be referred to as a second length. At least 20 percent of the extending monofilaments are composed of the first length and at least 20 percent are composed of the second length. It is preferred that each length comprise half of the extending filaments but this proportion may vary within the prescribed limits.
20 It has been found that at least 20 percent of the monofilaments must be of the second, or longer, length in order that the curved portions thereof intermingle with each other over a substantial surface area of the turf to give the appearance and feel of natural grass.

One embodiment of the process of the present invention contemplates making a simulated-grass recreational surface or synthetic turf by weaving a loop pile carpet structure, the loops of said carpet structure being made of a synthetic mono-

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filament having a flat, ribbon-like configuration. A first row of loops is cut near the tips thereof and then tension is applied to an adjacent row of filaments to pull out the cut ends out of the backing layer. These two steps are repeated alternately along the carpet to provide a cut pile carpet having pile filaments of two different lengths.

Referring now in detail to the drawing, in Figure 1 there is shown a simulated-grass recreational surface comprising a backing 10, from which extend a plurality of synthetic monofilaments in two lengths, 11 and 12, with length 12 extending at least twice the distance of length 11. The monofilaments of length 12 also have a curved portion. The backing layer 10 is a woven structure which can be fabricated on a carpet loom in such a manner that picks 13 hold filament loops 16 in an upright position. For clarity the warp threads are omitted from the drawing. This type of carpet weaving is conventionally done on a Wilton or Velvet loom.

The filaments making up the loops 16 are extruded synthetic thermoplastic monofilaments in ribbon form and have a denier of at least 300 and preferably within the range of 300 to 1200, a width in the range of 0.01 - 0.3" (0.0254 - 0.762 cms) and a thickness in the range of 0.001 - 0.003" (0.00254 - 0.00762 cms). The filaments, which are generally flat and ribbon-like to simulate natural grass and possess suitable bending properties, may be pigmented green to simulate the color of grass. Other colors may be used for special effects.

By "ribbon" is meant an extruded thermoplastic monofilament having a substantially rectangular cross-section.

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Among the thermoplastic compositions which may be used for making the ribbon are nylon, polypropylene, acrylic, polyester, (e.g. polyethylene terephthalate) etc. Of these, nylon is preferred.

The monofilament ribbons run along the backing layer in courses as shown in Figure 2 with the loops 16 being arranged in rows perpendicular to the courses. At this stage of the fabrication the recreational surface has the construction and configuration of a woven loop pile carpet.

10 The wires used in the weaving of this recreational surface are those conventionally used in the making of cut pile woven carpets with the exception that the knives utilized for cutting the loops are removed, from e.g., half of the wires (i.e., every other wire). Figure 3 shows the conventional wire 19 which has an enlarged head 20 and a cutting blade 21. When the wire 19 is pulled along the row of loops to remove it therefrom, the blade 21 will sever each loop at or near the tip thereof to convert the carpet from a loop pile carpet to a cut pile carpet.

20 Figure 4 shows a wire 24 having an enlarged head 25 but no cutting blade 21. The purpose of this wire 24 will be explained hereinafter.

The wires 19 and 24 are used alternately in fabricating the recreational surface. In other words, if it is desired, as preferred, to make a turf with 50 percent long length and 50 percent short length monofilaments, as the carpet is woven each wire 19 will be positioned between two wires 24 and each wire 24 will be positioned between two wires 19. A number

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of these wires are utilized in weaving the carpet and as each new loop 16 is formed the wire most remote from that loop is pulled out of its row of loops in a well known manner.

The first row of loops is formed on one of the wires 19 with a blade 21 while the second row of loops is formed on one of the wires 24 without a cutting blade. When the wire 19 in the first row of loops is withdrawn the blade 21 severs the row of loops near the tips thereof. Then when the wire 24 (without a blade) is withdrawn from the next row of loops the enlarged head 25 applies tension to the loops in this row to pull out of the backing layer that portion of each of the filaments extending to the cut made in the first row of loops. The third wire, which has a blade 21, is then withdrawn and the blade 21 severs the loops in this row at the tips thereof. Then when the fourth wire which has no blade is withdrawn, it pulls out that portion of each of the filaments extending to the cut in the preceding row. These steps of severing and pulling are repeated sequentially on the successive rows of loops.

As shown in the drawing the synthetic turf product has approximately 50 percent short length and 50 percent long length ribbon making up the pile, that is, every other loop is cut. It is to be understood, however, that this is only a preferred method of making the product of the invention. It is of course possible to vary the sequence to provide for more or for less of the longer filaments.

It can readily be seen that the cutting and pulling operations performed successively along the carpet as described

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hereinabove result in a synthetic turf having a cut pile of two different lengths. The length of the shorter cut pile filaments 26 will be substantially equal in length of the looped pile 16 prior to the cutting. The length of the longer cut pile filaments 27 will be (measured along the filament) approximately two to three times the length of the shorter filament 26. While the shorter filament 26 will have a fairly straight configuration, the longer filament 27 will have a configuration similar to that shown in Figure 2. Each of the longer filaments 27 has a curved portion 29 and a fairly sharp bend or elbow 30. The bend or elbow 30 is caused by deformation of the filament 27 which is caused as tension is applied to the filament 27 as it is held by the pick 13.

The curved portion 29 is a result of pulling the filament 27 under tension over the sharp edges of the wire 24. The wire 24 is thin and has relatively sharp corners. As the enlarged head 25 passes through the loop it applies tension to the filament 27 which, as it pulls out of the backing layer, is drawn across the sharp edges of the head 25 under tension.

20 This effects a change in the molecular orientation of the side of the filament 27 in contact with the sharp edges of the wire 24. Since the molecular orientation on one side of the filament is different from that on the other side, the filament will tend to bend or curl as illustrated in Figure 2.

It is not quite understood why but a golf ball stroked across this surface travels along a straight line with no deviation therefrom as the ball comes to a stop. Perhaps it is because the longer filaments 27, while retaining basically the

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configuration shown in Figure 2, tend to assume random positions (rather than the orderly positions shown in Figure 2) so that the same resistance is offered to the ball regardless of its direction of travel relative to the warp of the fabric. Of course, if this fabric is utilized on a slope the force of gravity will have some effect on the direction of ball travel. However, this direction of travel will not be influenced or changed because of the nature of the surface 12.

10 A further advantage of this synthetic turf is that the ball deceleration rate on this turf is very similar to that of natural turf. On conventional synthetic turf a golf ball will roll several times as far, when impelled by a given force, as it will on natural turf. This undesirable characteristic is overcome in the present invention.

It is of course within the purview of the present invention to construct a synthetic turf wherein the filament loops 16 are composed of a plurality of monofilament ribbons, for example, prior to being woven into the backing, a plurality, say six, ribbons are grouped together and thereafter, this group 20 is woven into the backing. In some cases, this is even preferred since when these loops are cut, the several ends of the short length tend to flair out from each other, and likewise, when pulled from the backing, the ends of the long length separate causing more intermingling thus producing a closer resemblance to natural grass.

It is to be understood that the embodiment disclosed herein merely illustrates the invention and that numerous other embodiments can be contemplated without departing from the spirit and scope of the invention.

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THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE
PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A synthetic turf characterized by a backing layer, a plurality of synthetic thermoplastic cut pile monofilaments of similar denier anchored in the backing layer and extending therefrom in at least two lengths, at least 20% of said monofilaments extending in a first length and at least 20% of said monofilaments extending in a second length which is at least twice as great as said first length, said monofilaments extending in said second length each having a curved portion.
2. The synthetic turf of Claim 1, characterized in that the monofilaments of said second length intermingle with each other over a substantial area of said turf.
3. The synthetic turf of Claim 1, characterized in that the thermoplastic is nylon.
4. The synthetic turf of Claim 1, characterized in that the thermoplastic is polypropylene.
5. The synthetic turf of Claim 1, characterized in that the thermoplastic is polyester.
6. A synthetic turf of Claim 1, characterized in that the monofilaments is in the form of a ribbon and has a denier above 300.
7. The synthetic turf of Claim 1, characterized in that each of the longer filaments has along at least a portion of the length thereof a molecular orientation which varies from one value on one side of the filament to another value on the other side of the filament to thereby impart a curl to each said filament.

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8. The synthetic turf of claim 2, characterized in that the thermoplastic monofilament is nylon in the form of a ribbon having a substantially rectangular cross-section and a denier above 300.

9. The synthetic turf of claim 2, characterized in that the thermoplastic monofilament is polypropylene in the form of a ribbon having a substantially rectangular cross-section and a denier above 300.

10. The synthetic turf of claim 2, characterized in that the thermoplastic monofilament is polyethylene terephthalate in the form of a ribbon having a substantially rectangular cross-section and a denier above 300.

11. A method of making the simulated-grass carpet of claim 1, which comprises:

(a) fabricating a carpet having a backing from which extends a plurality of courses of loops made of a synthetic filament having a flat ribbon-like configuration, said loops being positioned in rows extending across the carpet in a direction transverse to said courses,

(b) severing the loops in a first row at a point near the tips of said loops,

(c) applying tension to a second row of said filaments adjacent to the first row to pull out of the backing that portion of each synthetic filament extending to said point of severing in said first row, and

(d) alternately repeating steps (b) and (c) in sequence along the carpet;

said method being characterized in that the loops in said second row are pulled under tension across a sharp edge as they are pulled out of the backing, said sharp edge acting to change the molecular orientation of one side of each filament in said second row to thereby cause said filament to curl.

12. The method of claim 11, characterized in that the synthetic filament has a denier in the range of 300 to 1200.

13. The method of claim 11, characterized in that the ribbon has a width in the range of 0.01 - 0.3 inches (0.0254 - 0.762 cms).

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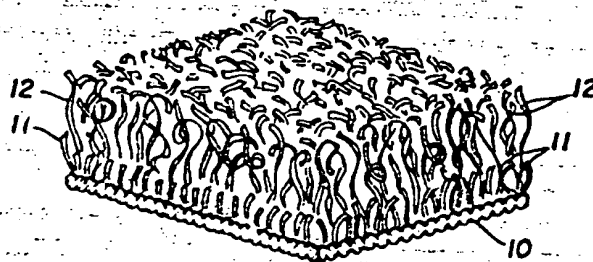


FIG. 1.

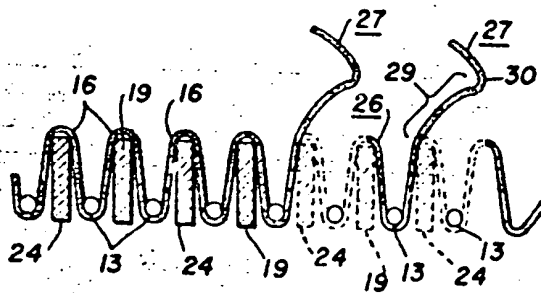


FIG. 2.

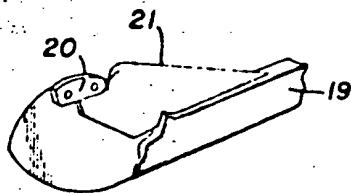


FIG. 3.

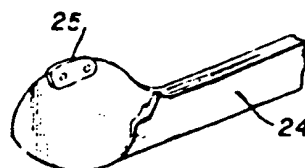


FIG. 4.

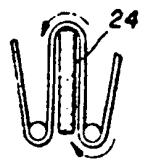


FIG. 5.